

WHAT IS CLAIMED IS:

1. In a method for making an ion exchange coating on a substrate, the steps of:
 - (a) reacting at least a first amine compound comprising amino groups selected from the group consisting of ammonia, a primary and a secondary amine, with at least a first polyfunctional compound, having at least two functional moieties reactive with said amino groups, in the presence of a substrate to form a first condensation polymer reaction product, with a first unreacted excess of either at least said first amino group or polyfunctional compound functional moieties, attached to said substrate, and
 - (b) reacting at least a second amine compound, comprising amino groups selected from the group consisting of ammonia, a primary and a secondary amine, or at least a second polyfunctional compound with the unreacted excess in the first condensation polymer reaction product to form a second condensation polymer reaction product.
2. The method of Claim 1 in which said substrate includes anion functional moieties on its surface and said attachment is by electrostatic bonding between said condensation polymer amino groups and said anion functional moieties.
3. The method of Claim 1 in which said substrate has a surface comprising an organic polymer.
4. The method of Claim 1 in which said two functional moieties of said first and second polyfunctional compounds include at least one functional moiety selected from the group consisting of epoxides, alkyl halides, benzylhalides, tosylates, methylsulfides and mixtures thereof.
5. The method of Claim 1 in which said at least two functional moieties of said first and second polyfunctional compound comprise epoxide moieties.
6. The method of Claim 1 wherein after step (b) said second amino group or second polyfunctional compound functional moieties are in unreactive excess in said second condensation polymer reaction product, said method further comprising

(c) reacting at least a third amine compound, comprising amino groups selected from the group consisting of ammonia, a primary and a secondary amine, or a third polyfunctional compound with said second condensation polymer reaction product, said third amine compound or third polyfunctional compound being reactive with said unreactive excess in said second condensation polymer reaction product, to form a third condensation polymer reaction product.

7. The method of Claim 6 further comprising repeating step (c) at least one more time and reacting amine reactive functional moieties on the exterior surface of said coated substrate after said repeating step with an amine containing cation functional compounds to convert the packing to a cation exchange substrate.

8. The method of Claim 6 in which said third condensation polymer functional group is cross-linked.

9. The method of Claim 6 in which said third condensation polymer functional group includes branched polymer chains.

10. The method of Claim 1 in which steps (a) and (b) are performed in a flowthrough chamber by sequentially flowing said first and second amine compounds and first or second polyfunctional compounds past said substrate.

11. The method of Claim 1 in which step (a) is performed on a plurality of said substrates in the form of particles and said coated substrates comprise ion exchange packing particles.

12. The method of Claim 11 in which step (a) is performed on a plurality of said substrates in the form of particles and wherein said coated substrates comprise ion exchange packing particles, said coated particles are removed from said chamber in a form suitable for use as chromatographic packing.

13. The method of Claim 1 in which said substrate comprises a flow-through monolithic medium.

14. The method of Claim 1 in which said substrate comprises a wall of a flow-through hollow tube.
15. The method of Claim 1 further comprising reacting a third amine compound with said first polyfunctional compound in step (a).
16. The method of claim 1 further comprising reacting a third polyfunctional compound with said first amine compound in step (a).
17. The method of Claim 1 further comprising reacting a third amine compound or third polyfunctional compound with said excess first amine compound or first polyfunctional compound in step (b).
18. The product formed by the method of Claim 1.
19. The product formed by the method of Claim 6.
20. A coated ion substrate exchange in which said coating comprises at least a first and second condensation polymer reaction product, said first reaction product being attached to said support and comprising a first condensation polymer reaction product of at least a first amine compound, comprising amino groups selected from the group consisting of ammonia, a primary and a secondary amine, and at least a first polyfunctional compound with at least two functional moieties reactive with said amino groups, and said second condensation polymer reaction product comprising the reaction product of either said at least first amine compound or said at least first polyfunctional compound with at least a second amine compound or second polyfunctional compound.
21. The coated substrate of Claim 20 in which said two functional moieties of said first and second polyfunctional compound include at least one functional moiety selected from the group consisting of epoxide, alkyl halides, benzylhalides, tosylates, methylsulfides, and mixtures thereof.

22. The coated substrate of Claim 19 in which said substrate comprises a flow-through monolithic medium.
23. The coated substrate of Claim 20 in which said substrate comprises a wall of a flow-through hollow tube.
24. The coated substrate of Claim 20 in which said at least one of said two functional moieties of said first and second polyfunctional compounds comprise epoxide moieties.
25. A plurality of the coated substrates of Claim 20 in the form of particles comprising ion exchange packing particles.
26. The coated substrate of Claim 20 in which the outer surface of said coating includes amino functional groups bound to cation functional groups.
27. The coated substrate of Claim 1 in which said substrate has a surface comprising an organic polymer.
28. The coated substrate of Claim 20 in which said substrate includes anion functional moieties on its surface and said irreversible attachment is by electrostatic bonding between said first condensation polymer amine functional moieties and said anion functional moieties.
29. The coated substrate of Claim 20 in which said third condensation polymer functional group is cross-linked.
30. The coated substrate of Claim 20 in which said third condensation polymer functional group includes branched polymer chains.